STATUS OF THE DEPARTMENT OF ENERGY
NUCLEAR CRITICALITY SAFETY PROGRAM
FOR CALENDAR YEAR 2004

1. Introduction

In a letter dated August 7, 2003, the Defense Nuclear Facilities Safety Board (DNFSB) closed Recommendation 97-2, *Criticality Safety*, and established an annual reporting requirement. The enclosure to the DNFSB letter requested that a status of the following items be provided annually:

- Updates to the Nuclear Criticality Safety Program (NCSP) Five-Year Plan including the status of individual projects in the program.
- NCSP Funding (actual and projected).
- Critical experiments status and Los Alamos National Laboratory (LANL) Technical Area (TA)-18 Relocation Program status.
- The status of contractor criticality safety engineer training and qualification programs.
- The status of Federal criticality safety engineer training and qualification programs.
- A summary of lessons learned from criticality safety program assessments.
- A summary of lessons learned from Criticality Safety Support Group (CSSG) reviews of proposed nuclear criticality safety controls for new facility designs.
- A summary of the results of trending and analysis of reportable and non-reportable criticality safety occurrences.
- The status of open issues identified in the previous annual report.

This annual report is structured to address each of these areas in the order in which they appear above.

In addition to the 9 items, cited above, in a letter dated April 5, 2004, the DNFSB cited three other opportunities for improvement based on their review of the 2003 NCSP Annual Report.

- The Board's letter of August 7, 2003, stressed the value of proactive rather than reactive initiatives as key elements in the enhancement of nuclear criticality safety throughout the Department of Energy (DOE) defense nuclear complex. The Board's position is that DOE's reviews of the effectiveness of actions taken to improve nuclear criticality safety must be much more comprehensive, especially with regard to collection of data at the field level by knowledgeable nuclear criticality safety professionals.

- The Board's letter noted that the 2003 NCSP Annual Report does not provide adequate information with regard to the staffing levels of both contractor and federal nuclear criticality safety personnel. While the report specifies the number of qualified/not-yet-qualified personnel in each case, it does not clearly show that this number has been

analyzed and determined to be adequate. For those cases in which a vacancy is found to exist, clear plans, as well as interim compensatory measures, must be provided.

- The Board's position is that DOE's efforts to conduct trending and analysis must be brought to a much more mature level. Likewise, the ability to develop and disseminate useful lessons learned must be improved.

These opportunities for improvement noted by the DNFSB are addressed in the various sections of the annual report.

2. Updates to the NCSP Five-Year Plan and a Status of individual projects in the program.

The NCSP Five-Year Plan contains details on the program structure, budget and scheduled activities. A copy of the latest version of the plan, dated October 2004, is attached.

A status of the individual program elements is as follows:

Applicable Ranges of Bounding Curves and Data (AROBCAD)

- Training materials for AROBCAD software were developed.
- Training in the use of TSUNAMI was provided to the CSSG at the March bi-annual meeting in Las Vegas, BWXT Idaho National Environmental Engineering Laboratory, Washington Safety Management Solutions at Savannah River, and Hanford Flour nuclear criticality safety organizations based upon Oak Ridge National Laboratory (ORNL) analyses of site-specific nuclear criticality safety problems. In addition, a TSUNAMI tutorial was presented at the Pittsburgh American Nuclear Society Meeting in June 2004.
- The generalized linear least squares method (GLLSM) code, TSURFER, was finished and is scheduled to be released late 2004 or early 2005 and associated training materials are currently being developed.
- The building of a "Sensitivity Data File" consisting of about 500 experiments (to date) for incorporation with a future revision to the Standardized Computer Analysis for Licensing Evaluation (SCALE) software is progressing.
- The AROBCAD software products (TSUNAMI-1D, TSUNAMI-3D, Javapeno, and SMORES) were released by ORNL Radiation Safety Information Computational Center (RSICC) as a part of the SCALE 5 release in the spring 2004.
- Code development/debugging has been progressing steadily due to recent TSUNAMI evaluations in support of the following work:

- Comprehensive Organization for Economic Cooperation – Nuclear Energy Agency (OECD-NEA) Mixed Oxide (MOX) fuel experimental needs analyses;
- Modeling of Department of Energy (DOE) Office of Environmental Management (EM) Irradiated Fuel Storage Facility (IFSF) project at the Idaho National Laboratory (INL); and
- The DOE Office of Nuclear Energy, Science and Technology (NE) space power reactor safety analyses.

- Code modifications continued for performing the adjoint solution in both KENO-V and KENO-VI.
- The differentiation code, GRESS, has been transitioned to FORTRAN-90 for the differentiation of the CENTRM cross section processing code to be used with ENDF/B-VI and TSUNAMI. There has been success in demonstrating its capability on a limited number of nuclides in a single mixture.
- Publications for review and distribution included:
  - A journal article, regarding the new SCALE 5 Pitzer solution-modeling capability for performing sensitivity analyses, has been submitted and reviewed for publication in Nuclear Technology;
  - A journal article, regarding Sensitivity-and-Uncertainty-Based Criticality Safety Validation Techniques, has been submitted and reviewed for publication in Nuclear Science and Engineering; and
  - A journal article, regarding Perturbation Theory Eigenvalue Sensitivity Analysis with Monte Carlo Techniques, has been submitted and reviewed for publication in Nuclear Science and Engineering.

<u>Analytical Methods Development and Code Support</u>

Criticality Safety Analyses: The NCSP continued to support the criticality safety community in providing independently-redundant, corroborative analytical methods for production analyses (SCALE/KENO and MCNP5) and critical experiment benchmarking analyses (VIM and MCNP5). This effort, performed by software specialists at ORNL, LANL and Argonne National Laboratory (ANL), involved quality assurance through software maintenance, training through the conduct of multi-day, hands-on workshops, and user assistance in the performance and evaluation of analyses for a wide variety of DOE applications.

New Methodology: RSICC packaged and distributed a major new version of SCALE (SCALE 5) and an enhanced version of MCNP5 (MCNP5 1.30). The new software includes additional

capabilities for performing transport analyses, as well as improved methods for problem-dependent data processing. Progress was made in the development of a WINDOWS PC version of VIM. New procedures were established for RSICC code distribution that simplify multiple code use at DOE sites with a single site-responsibility for meeting Export Control qualifications.

Cooperative Studies: The NCSP-sponsored analytical capabilities were utilized in the evaluations performed by the International Criticality Benchmark Evaluation Project (ICSBEP), as well as in other international studies coordinated through the OECD-NEA Working Party on Nuclear Criticality Safety (WPNCS). Notably, the fission source convergence studies, chaired by ANL, are being documented and NCSP-sponsored expertise performed a major role in the evaluation of critical experiments for the validation of MOX operations.

An in-depth survey was conducted on the capabilities and features of the three code systems presently sponsored by the NCSP, as well as those of the COG and PREPRO software developed at Lawrence Livermore National Laboratory (LLNL). On the basis of this survey, NCSP financial support will continue for upgrades to the LLNL nuclear data-processing methods and for an small internal LLNL effort to export advanced COG features to the other code communities.

International Criticality Safety Benchmark Evaluation Project

The annual ICSBEP Meeting was held in San Lorenzo del Escorial, Spain, during May of 2004. A total of 39 participants from United States, Russian Federation, United Kingdom, France, Japan, Spain, Brazil, and the Czech Republic attended the meeting. Thirty-three new evaluations and two evaluations that were revised to include additional configurations were discussed at the meeting along with several other evaluations that underwent less significant revision. Included, for the first time, were two evaluations of measured data that may be used to validate neutron transport through various labyrinth configurations and one evaluation of a Californium source, heavily shielded by iron. These data are useful for validation of calculations made to determine the need for and placement of criticality alarms. Twenty nine of the thirty three evaluations were eventually approved for publication. One evaluation was withdrawn, but should be resubmitted in 2005. None of the criticality alarm type benchmarks was finalized in time for publication; however, one of the labyrinth benchmarks was published as a draft and comments were requested from the criticality safety community. This evaluation includes benchmark specifications for six labyrinth type configurations with multiple measurement points for each.

The 2004 Edition of the "International Handbook of Evaluated Criticality Safety Benchmark Experiments" was published in September 2004. Included in this version of the handbook are 29 newly approved evaluations and a *draft* version of one of the three-criticality alarm placement benchmarks. The handbook now contains 379 approved evaluations that span over 30,000 pages and provide 3331 critical or accurately known subcritical configurations that may be used by criticality safety analysts for validation of their analytical methods and data or by nuclear data

evaluators to improve basic nuclear data. An improved version of the database, called DICE, is also included on the 2004 DVD. The ICSBEP Intranet Site (http://icsbep.inel.gov/) was updated to include the new 2004 data.

Use of the ICSBEP Handbook has broadened significantly. As evidenced in several papers presented at the International Conference on Nuclear Data for Science and Technology, ND-2004, and the annual meeting of the Cross Section Evaluation Working Group (CSEWG), ICSBEP Handbook data are being much more frequently used for testing and improvement of basic nuclear data.

Nuclear Data

Nuclear Data Advisory Group (NDAG): The NDAG, under the chairmanship of ANL, has continued its semi-annual meetings to establish areas where improvements in nuclear data measurements and evaluations are needed. With the maturity of the NCSP Nuclear Data Work Element allowing the extension of capabilities to other DOE programs, notably DOE/EM, an effort has been initiated to canvas all DOE programs utilizing nuclear data to determine where data needs are overlapping in applications.

Nuclear Data Measurements: The NCSP continued to support the operation of the Oak Ridge Electron Linear Accelerator (ORELA) facility at ORNL in the performance of neutron cross section measurements in the resonance or intermediate-energy range. Measurements were performed on ^{39}K and ^{41}K. Preparations were made for continued measurements on ^{55}Mn. However, a series of equipment failures and technical difficulties limited the ORELA output in this fiscal year.

Nuclear Data Evaluations: Resonance-energy evaluations with the SAMMY code at ORNL and high-energy (> ~500 keV) evaluations with the GNASH code at LANL were performed for a number of nuclides important to criticality safety evaluations. New evaluations for the fissile nuclides, as well as fuel packaging and storage materials, are being submitted to the National Nuclear Data Center at BNL for testing and release in the upcoming ENDF/B-VII data compilation. Preliminary testing by LANL has shown significant improvement in the analysis of fast and thermal uranium-fueled critical experiments.

Cooperative Studies – The NCSP-sponsored SAMMY software is being utilized in the international studies coordinated through the OECD/NEA Working Party on Evaluation and Cooperation (WPEC). WPEC activities include the development of cross section uncertainty files and covariance matrices. Work in these areas is being performed at ORNL, LANL and ANL. Additionally, NCSP-sponsored expertise is participating in the evaluation of nuclear data standards, an activity coordinated through the International Atomic Energy Agency (IAEA).

Nuclear Data Staff: An effort was initiated in FY03 to attract young technical staff into the NCSP sponsored nuclear data work areas at ORNL and LANL. Through the Nuclear Theory Task, a nuclear model expert was brought to ORNL to work on the methodology for analyzing direct neutron capture. Initially on a post-doctoral assignment, this expert is now a member of the ORNL Nuclear Data Group. Additionally, the Nuclear Data Group has added an expert in data-processing and an expert/trainee in data evaluation. A new technician has been added to the ORELA staff to replace an ORELA staff retiree. Also, the LANL T-16 Group has added an expert in data uncertainty evaluation, who has performed leadership roles in the WPEC international activities in this area.

Integral Experiments

During FY 2004, seven major experiments were completed, including: Neptunium/Highly Enriched Uranium (Np/HEU) reflected by Iron, Np/HEU reflected by Polyethylene and Gadallinium-alloy mixed with Highly Enriched Uranium. One new experimental activity was started (Component Benchmark Experiment). Two experimental activities are ongoing (Special Moderator and Source Jerk).

In terms of the training and proficiency, seven criticality safety classes were conducted in FY 2004: four 2-day classes, two 3-day classes and one 5-day class. This training averaged 12 students per class. LANL continued to train operators and maintain proficiency on the critical assemblies. The critical experiments facility had over forty five experimental days, which the NNSA considers acceptable given the increased workload associated with the relocation project and the LANL stand-down that began in July 2004.

Researchers at the critical experiments facility submitted four benchmark evaluations to the ICSBEP for publication. In addition, three papers were published in the Journal of Nuclear Material Management and Journal of Nuclear Science and Engineering.

Information Preservation and Dissemination

The Criticality Safety Information Resource Center (CSIRC) at LANL serves as the NCSP focal point for collecting and preserving documents directly related to critical experiments and criticality safety. During 2004, CSIRC completed several significant activities that included compilation of the Rocky Flats Environmental Technology Site (RFETS) Critical Mass Laboratory History, scheduled for publication in early calendar year 2005; completion of the RFETS Logbook index; publication of LA-14098, "Modern Fission Theory for Criticality"; and completion of LA-UR-04-6514, The Heritage and Usage of the Words Fissionable and Fissile in Criticality".

Other activities aimed at preservation and dissemination of criticality safety information were accomplished at Hanford. Improved criticality safety information retrieval and presentation

efforts included validation and reissue of ARH-600 as a computerized handbook and updating the Hanford topically screened parameter study database.

All pages in ARH-600 were scanned and the approximately 1600 curves available were digitized. The scanned pages were labeled, indexed, and incorporated in an electronic hypertext version (HTML index with linked PDF files). A successful demonstration of the electronic hypertext version was presented during the March CSSG meeting and at the summer American Nuclear Society meeting. The present electronic hypertext version is being installed on the NCSP web site at Livermore for general use. Supplemental information was generated utilizing MCNP4C such that 6000 curves are available to be included in the interactive, electronic reissue. An alpha version of the computer program, CritView, has been prepared to allow concept demonstration, and improved interactive information manipulation and retrieval for the final product.

The Hanford database was increased by 516 new entries. With this addition the total number of items is 4748. Current criticality safety literature was screened for potential additions. Significant contributions were obtained from the 2003 International Conference of Nuclear Criticality. Almost all new entries are provided with abstracts facilitating word searches in addition to topical compilations. Approximately 130 entries have the OSTI ID number included to facilitate full document retrieval. The database is available at the NCSP Livermore web site. Efforts to enhance search flexibilities have been successfully performed during 2004.

Regarding the NCSP Website, accomplishments for calendar year 2004 are as follows. A new NCSP web site design was released that included a new DOE logo and background pictures. Approximately 13,000 web pages of the NCSP web site were modified. Over 250 annual user information verification email letters were sent and 115 users registration information records were updated. LLNL Bibliography and Hanford NCTSP databases now contain over 12,000 bibliographic entries. During the last twelve months both of these databases have been accessed a total of 17380 times. Also, during calendar year 2004, the NCSET training modules have been downloaded over 2964 times. As for site visits, the average access rate is 29.66 hits/day. The website has received over 26,405 total visitors since its inception in 1998.

Training and Qualification

The training and qualification element of the NCSP made steady progress in 2004 Hands-on training at LANL continued as described in the Integral Experiments Section, above. Qualification activities continued as described in Section 5 and Section 6, below. As for training development, the second Nuclear Criticality Safety Engineer Training (NCSET) module on hand calculations was started, but then put on hold in favor of working a primer that parallels the first module and includes what was intended for the second module. This primer will be completed early next year and will serve as the basis for the second NCSET module. In addition, NCSP training development funds were provided to LANL to develop a non-destructive analysis (NDA) tutorial that was offered at the November American Nuclear Society winter meeting in

Washington, D.C. Approximately 50 people attended this tutorial that focused on NDA techniques and assumptions, potential inaccuracies associated with these techniques and their impacts on criticality safety evaluations. The NDA tutorial is also being converted to a NCSET module and will be added to the NCSP website in FY 2005.

3. NCSP funding

NCSP funding has been stabilized and continues to receive appropriate financial support to execute program task elements focused on maintaining criticality safety capability. Table ES-1 of the NCSP Five-Year Plan (attached) contains the planned funding levels for Fiscal Year (FY) 2005 through 2009. This level of funding is adequate for maintaining capability in NCSP program task elements and addressing identified requirements. NNSA's FY 2005 appropriation includes $10,125 million , and all funds have been distributed according to the Work Authorization Statement text contained in Appendix B of the NCSP Five-Year Plan. The FY 2006 funding ($9,789 million) identified in Table ES-1 of the Five-Year Plan is in the President's FY 2006 budget request that will be submitted to Congress in February 2005. Defense Programs is committed to continue providing adequate support for the NCSP.

4. Critical experiments status and Los Alamos Technical Area 18 Relocation Program status

The critical experiments program at LANL made progress in 2004. As stated above, seven experiments were completed and four benchmark evaluations were submitted to the ICSBEP for publication during calendar year 2004. In 2005, plans include two experiments and publication of four benchmarks. More detailed information on the critical experiments program is contained in Section 6 and Appendix F of the NCSP Five-Year Plan.

Regarding the LANL Technical Area (TA)-18 Mission Relocation Program, on March 31, 2004, the National Nuclear Security Administration (NNSA) announced an initiative to accelerate special nuclear material (SNM) moves from TA-18 to the Device Assembly Facility (DAF) at the Nevada Test Site (NTS). The decision to reduce the TA-18 security posture below security category I/II levels by September 30, 2005 was driven by a requirement to either de-inventory TA-18 by that date or implement the new design basis threat (DBT). Implementing the new DBT at TA-18 was determined by NNSA to be cost prohibitive. Any SNM not moved to DAF by September 30, 2005, will be staged at another secure location until it can be shipped.

The Criticality Experiments Facility (CEF) Project, formerly the TA-18 Mission Relocation Project, includes facility design and modification activities necessary to relocate the capabilities from TA-18 to the DAF and other supporting facilities at the NTS. The DAF modifications will include locations to house four critical assemblies and SNM vaults to accommodate TA-18 programmatic SNM. The design will include all of the provisions necessary for safeguarding the SNM and securing programmatic work from unauthorized personnel while allowing for cost and operational efficiencies. The design will preclude interference with adjacent facilities, while

optimizing the use of shared capabilities for reducing construction costs. The CEF project, sponsored by Defense Programs, received Critical Decision 1, Approval of Alternative and Cost Range on June 14, 2004. As part of this approval, the Nevada Site Office was designated as the lead field entity with LANL as the lead project contractor. Funding for the CEF Project (current range is $125M to $148M) is provided through a Congressional Line Item construction account. The project is scheduled for completion in late 2009.

Following the decision to de-inventory TA-18 by September 30, 2005, the NCSP manager has refined the requirements for initiating interim operations at DAF. Interim operations are defined as those proposed activities required for mission continuity of TA-18 programs from FY2005 through FY2008. The scope of the interim activities is based on the NCSP's minimum requirements to meet its commitments to internal and external customers, maintain personnel expertise, and to assure national security as well as worker safety. In FY 2005, the NCSP plans to conduct a limited number of security category I/II critical assembly operations at TA-18 to complete two experiments and support four training courses using two critical assemblies. NNSA will terminate all security category I/II critical assembly operations by July 2005 and de-fuel the 4 critical assemblies (Planet, Flattop, Comet, and Godiva) slated for transfer to DAF. In parallel, the NCSP plans to establish the capability to conduct sub-critical measurements at DAF in 2005. Once the critical assemblies are transferred to DAF, the only critical assembly that will remain in operational standby at TA-18 is the Solution High-Energy Burst Assembly (SHEBA) in its security category III/IV configuration. This assembly will remain in operational standby at TA-18 until a similar capability is established in Nevada. Additionally, the NCSP will study the feasibility of accelerating the relocation of critical assemblies to the DAF. The NCSP will coordinate operations with the Nevada Site Office and the CEF Project to assure construction activities are not adversely impacted. Beginning in 2006, the NCSP plans to conduct up to four criticality experiments per year at the DAF until completion of the CEF project in late 2009.

High priority is being given to reduction of impacts to operations during transition from LANL to the NTS. The TA-18 Closure Plan, signed by Ambassador Brooks, November 3, 2004, directed LANL to provide a detailed staffing transition plan by March 31, 2005. Both the NCSP Program Sponsor (NA-11) and the NCSP Manager are committed to maximize availability of critical experiments and training capabilities throughout the relocation of these important Defense Program missions. Phased transition of critical assemblies and associated special nuclear materials, detailed operational readiness review planning, table-top DAF operations exercises, comprehensive staff planning, and planned installation of a state-of-the-art high-speed secure video/data-acquisition system at the DAF with a link to LANL are examples of steps being taken to reduce transition time and risk and enhance operational safety and efficiency.

5. Status of contractor criticality safety engineer training and qualification programs

Contractor criticality safety programs at many DOE facilities are supported by trained and qualified criticality safety engineers (per DOE-STD-1135) reporting to the criticality safety

manager and by criticality safety officers (CSOs) reporting to operations line management. Typically, CSOs receive specialized additional nuclear criticality safety (NCS) training and provide the day-to-day line management operational awareness, oversight, and implementation function for NCS working closely with the criticality safety engineers. Sites that have utilized CSOs (or their equivalent) for a time such as Hanford, Rocky Flats, and Y-12 have found them extremely beneficial in improving on-the-floor implementation of criticality safety practices. With this in mind, Tables 1 and 2 contain information on contractor criticality safety engineer (CSE) and CSO positions respectively.

DOE NCS staff members in the field supporting DOE line management assess their contractors' staffing levels and budget requests. Responsible Site Office Managers, in consultation with the NNSA Administrator, determine the adequacy of Site Office staffing levels. If they discover shortfalls, they appropriately advise DOE line management at the field/site office level and develop appropriate corrective actions.

TABLE 1 – CONTRACTOR PERMANENT CSE STAFFING AND QUALIFICATION

Site/Contractor	Number 1135 Qualified	Number in Training	Additional Needed	Open positions	Delta in CSE Needs from 2003	Comments/Plans/ Interim Comp Measures
ANL (Univ. of Chicago)	8	2	0	0	0	The ANL/INL realignment will cause these figures to change in the coming year in a way still being determined by site line management.
LLNL (Univ. of California)	9	0	0	0	-1	LLNL staffing levels are largely in response to program needs. One staff member retired this year; due to reduced weapons program needs, this position was not filled.
Hanford (Fluor Federal Svcs)	16	2	1	1	+2	D&D projects cause temporary surges that are met using qualified subcontractors.
INL (Bechtel BWXT Idaho)	8	0	0	0	0	Increases in the number of NCS resources may be needed due to the pending realignment of ANL/INL (see note above under ANL).
LANL (Univ. of California)	7	0	TBD	0	+1	Interim comp measure being used is negotiation with facility to stretch out work and apply NCS resources only to highest priority tasks. One senior NCS staff member retired and new NCS management is reviewing current staffing needs. Requisitions will be open (if applicable) upon approval of staffing plan.
SNL (Lockheed Martin)	3	2	0	0	+3	CSE duties are collateral at SNL; no one is a full-time CSE. Two qualified subcontractor CSEs support the three qualified SNL CSEs. The increase is due to more stringent requirements and the need to add flexibility. The SNL Technical Support Group grew by two nuclear engineers, one of which has qualified and the other is nearly qualified. Other staff members obtained their NCS qualification for professional development.
Pantex (BWXT Pantex)	2	1	0	0	+1	Additional resource in-training to support increased workload.
RFETS (Kaiser-Hill)	2	0	0	0	-1	Site CSE resource decreases to only 1 in January 2005. Site closure is April, 2005. Contingency plan in place to use subcontractor support if needed between January and April. Site successfully transitioned to removal of all CAAS and NCS program termination with no significant NCS incidents.
Y-12 (BWXT Y-12)	25	6	6	2	-2	Qualified subcontractors are used to meet resource shortfalls. A revised staffing plan was recently approved for six additional positions in FY05 for which the remaining 4 requisitions will be opened. Currently, overall staffing level is adequate to meet funding demands. This effort is to adjust mix of subcontractor and permanent staff.
East Tennessee Technology Park (ETTP) (BNFL)	4	0	0	0	-1	ETTP 3 Bldg. D&D Project scheduled to complete 12/31/04. No active fissile processes (excluding static storage) will exist after 12/31/04. After January, 2005 NCS resources will be provided on an as needed (i.e. on-call) basis only.
ETTP/Ports/Pad (BJC and its major subs)	22	2	1-2	1	-3	Resources down from last year due to completion of several generic D&D evaluations being done by subcontractor support. The K-25 Project has now achieved a staffing level that will be stable over the next year or two.
ORNL (UT-Batelle)	2	1	TBD	0	0	NCS Staffing needs are currently under review. 1135 qualified subcontractors used meet temporary surges in workload. ORNL project subcontracting reduces reliance on UT-Batelle NCS staff (e.g. 3019 and ISOTEK).
SR (WSMS)	19	1	0	0	-10	SRS has reduced direct support numbers because fewer nuclear criticality safety evaluations (NCSEs) are being done; daily support requirements are reduced due to deactivation/closure of some processes. For example, the Pu processing Canyon and its finishing facility are well on their way to a long-term surveillance and maintenance mode after reaching a defined deactivation state.

TABLE 2 – CONTRACTOR CSO STAFFING

Site/Contractor	Number Of CSOs	Additional CSOs Needed	Open positions	Comments/Plans/ Interim Comp Measures
ANL (Univ. of Chicago)	N/A	N/A	N/A	
LLNL (Univ. of California)	14	0	0	LLNL's CSOs are program managers who are responsible for implementation of NCS controls for their own program.
Hanford (Fluor Federal Services)	7	0	0	One of the seven CSOs is still in training. Hanford CSOs host an annual on-site workshop/meeting to share lessons learned. This past year the Chairman of the CSSG was an invited speaker and participant.
INEL (Bechtel BWXT Idaho)	17	0	0	
LANL (Univ. of California)	11	0	0	CSOs responsibilities are typically part time (25%) duties of specified operations/technical staff members.
SNL (Lockheed Martin)	1	0	0	The CSO is also qualified as a CSE.
Pantex (BWXT Pantex)				
RFETS (Kaiser-Hill)	2	0	0	A third CSO is currently supplemental. The need for CSOs will go away when the site closes in 2005.
Y-12 (BWXT Y-12)	4	0	0	
ETTP (BNFL)	N/A	N/A	N/A	
ETTP/Ports/Pad (BJC and its major subs)	2	6	6	Currently, two CSOs is adequate. However, it is projected that 8 will be needed when the D&D work is in full swing. The site is therefore ramping up over the next several months to meet future needs.
ORNL (UT-Batelle)	N/A	N/A	N/A	
SR (WSMS)	N/A	N/A	N/A	

6. Status of Federal criticality safety engineer training and qualification programs

The DOE has made steady progress in improving its criticality safety expertise in recent years. This has been accomplished by hiring additional, experienced criticality safety professionals and by ensuring that all DOE staff overseeing criticality safety are formally trained and qualified.

DOE has hired criticality safety staff with significant criticality safety experience as practitioners to improve its criticality safety expertise. Individuals with more than a decade of experience practicing criticality safety have been added to DOE's staff at the Office of Environment, Safety and Health (EH), NNSA, EM, the NNSA Service Center, Idaho, Richland, and Oak Ridge over the past several years. In some cases, the individuals have several decades of criticality safety experience and are recognized nationally as experts in the field. These individuals fill GS-14 or Excepted Service level positions, which is indicative of the DOE's commitment to hire and retain exceptionally qualified staff.

The DOE issued comprehensive training and qualification standards for DOE staff. The DOE staff expectations were developed initially as a new Technical Qualification Program (TQP). Each site/area office has a criticality safety specialist qualified according to the TQP requirements. In several instances, oral examination boards made up of experts from the CSSG were held as part of the qualification process. A May 26, 1999, letter to Chairman Conway described the TQP developed for Federal staff. A February 22, 2001, letter to Chairman Conway reported that at least one Federal employee at each site with a criticality safety program had been qualified to the DOE qualification standard. The requirement to train and qualify DOE criticality safety staff is institutionalized. The TQP was revised and reformatted into a new DOE technical standard in 2003. This revised and updated Criticality Safety Functional Area Qualification Standard (DOE-STD-1173-2003) was issued in December 2003. This standard did not change the technical substance of the qualification program but represented a fundamental format change. It did update some ancillary expectations that will be addressed by line management as appropriate under individual professional development plans at the site level. There is no need or intent to requalify individuals based upon issuing the TQP as a DOE technical standard. These qualified Federal nuclear criticality safety personnel comprise the voluntary membership of the DOE Criticality Safety Coordinating Team (CSCT) that is chartered by the NCSP Manager.

Table 3 contains information on the current status of qualified DOE NCS staff.

TABLE 3 – DOE NCS STAFFING AND QUALIFICATION

Site/Contractor	Number Qualified	Number in Training	Additional Needed	Open positions	Delta in CSE Needs from 2003	Comments/Plans/ Interim Comp Measures
HQ (EH/EM/OA/NNSA)	3	0	0-2 TBD	0	0-2 TBD	The 2004-1 IP calls for CTA(s) in NNSA and EH that may need additional NCS expertise and these needs are still being evaluated as the IP is finalized and organizations realigned to meet commitments. Currently NNSA (from EH), EM and OA have qualified NCS staff.
NNSA LSO	1	0	0	0	0	
NNSA AL SC	1	1	0	0	+1	A new excepted service NCS staff member has been added to the AL NNSA Service Center to provide the additional needed technical support to Los Alamos, Pantex, and Sandia. The individual is an experienced (>20 years) criticality safety professional who should qualify quickly and provide valuable assistance to the site offices.
NNSA YSO	1	0	0	0	0	YSO has one Federal full time equivalent (FTE), supported by 0.85 FTE senior support service contractors. YSO nuclear criticality safety program oversight staffing needs for FY 2006 are currently being evaluated. The NNSA YSO NCS staff member was recently re-qualified to 1173 and the YSO Technical Qualification Standard.
NNSA NSO	0	0	1	0	+1	With the transfer of the TA-18 mission to the DAF, NSO will need to add a qualified NCS staff member to provide line criticality safety oversight. In the interim, NNSA NA-117 has obtained the services of an experienced qualified NCS SME and that individual will be working closely with NSO management to ensure that rigorous NCS programs are in place on both the NNSA and contractor sides to support the TA-18 mission transition. The individual is a member of the CSSG.
SR	3	0	0	0	0	The latest staffing needs evaluation conducted by the line organizations indicates the need for approximately 2.5 FTE in the criticality safety area. One of the qualified individuals is currently supporting site work outside of the criticality safety arena. Should the two actively involved personnel need assistance, the third individual is available to support.
RL	1	0	0	0	0	The RL NCS staff member also is qualified as a System Safety Oversight Engineer for the Plutonium Finishing Plant (PFP) Vital Safety System – Criticality Alarm System
CH	1	0	0	0	0	
ORO	1	0	1	1	-1	One qualified ORO NCS staff member left the Department during the year. ORO has posted a position to backfill. In the interim, EM and EH HQ NCS staff are being called upon to provide support (e.g. EH NCS staff provided support in the development of the K25/K27 D&D DSA; EM NCS staff will provide support on Criticality Accident Alarms). Both of these individuals are members of the CSSG.
NE ID	2	0	0	0	0	
NNSA LASO	0	1	0	0	0	A LASO staff member with expertise in nuclear safety has begun formal qualification to 1173 and should complete the qualifications in 2005. LASO NCS needs are met with this addition and the additional support from the SC.

7. Lessons learned from criticality safety program assessments

The mandatory ANSI/ANS-8 standards for criticality safety require criticality safety audits and self-assessments. In particular, every fissile material operation must be reviewed frequently, at least annually. Generally, contractor self-assessments performed byeither operations staff or the nuclear criticality safety staff occur monthly in some portion of any given plant. The requirement to review every fissile material operation is usually met by performing a systematic schedule of assessments over a small portion of the facility/site monthly, with the roll-up covering all areas in a year. Most site contractors utilize criticality safety committees in addition to line operations and nuclear criticality safety staff audits/assessments. The nuclear criticality safety committees often include external expertise to advise contractor management. Finally, it is a common practice for contractors to perform biennial or triennial comprehensive criticality safety program reviews by teams comprised of some mix of internal and external expertise. Standard practice at the sites is to capture findings from all these types of self-assessments in a site-specific corrective action-tracking database that contractor management uses as a tool to ensure that improvements occur.

It is important to differentiate self-assessment findings and observations from criticality safety deficiencies/infractions. The former are often programmatic or reflect deviations from expected policy or practice that do not involve specific criticality safety limits and controls. The latter explicitly arise from deviations from approved criticality safety limits, controls, and procedures as derived from criticality safety evaluations.

Site DOE criticality safety staff ensures that contractors have programs and procedures in place for performing the required self-assessments. This assurance is gained by conducting DOE line criticality safety assessments/reviews on an ongoing basis. These assessments examine program documentation, spot-checking self-assessment and corrective action-tracking reports, and frequently examining individual criticality safety evaluations and limits. DOE site criticality safety staff periodically tour fissile material facilities and operations, usually as a team with Facility Representatives. Site DOE criticality safety staff do not, in general, review every report of every audit/self-assessment performed by the contractor. DOE site line management holds its contractor management responsible for maintaining awareness of criticality safety issues and concerns based on feedback from all assessments and implementing corrective actions as needed.

If contractor self-assessments do identify criticality safety deficiencies/infractions, these are reported to contractor management and to the site DOE criticality safety staff. The site DOE criticality safety staff, collaborating with the CSCT, will then track and trend all criticality safety deficiencies/infractions.

The DOE issued a formal technical standard, DOE-STD-1158-2002, *Self-Assessment Standard for DOE Contractor Criticality Safety Programs*, as an aid to establish consistent, high-quality self-assessments. This standard was written with the intent of the entire scope being covered at a

site approximately every three years. Properly implemented, such a systematic self-assessment program will maintain best practices consistent with the expectation of the mandatory standard ANSI/ANS-8.19.

Most DOE contractors have incorporated DOE-STD-1158-2002 in some fashion as part of their ongoing self-assessment program. Some use it as part of their criticality safety committee protocol, some use it as part of their monthly self-assessment programs, and others utilize it for their biennial/triennial reviews. Typically, when site DOE offices conduct assessments of their contractor's criticality safety programs, the lines of inquiry from this standard are utilized.

In addition to these ongoing systems of line management self-assessments at the DOE site and contractor management level, DOE developed its implementation plan in response to Board Recommendation 2004-1. The Department will enhance its oversight and assessment function overall and the NCSP and CSSG expect to support improvements in this area as appropriate in accordance with the structure established by the IP. Details are still being worked out as to how the expertise resident within the CSSG will be leveraged to support these new activities.

The CSSG has had an active year providing technical assistance to the Department's site office managers relative to criticality safety self-assessments. The CSSG performed one 'official' CSSG NCS assessment and supported, or led, numerous other activities and assessments leveraging their considerable NCS expertise throughout the Department. In all, Hanford, Rocky Flats, Y-12, Sandia National Laboratory, New Brunswick Laboratory, the East Tennessee Technology Park (K25/K27), and the Idaho National Laboratory all received assistance by the CSSG in some form during the year at the request of the respective DOE site offices who provided the funding for these activities in the majority of cases.

In January 2004, a CSSG member developed a lessons learned white paper dealing with leading indicators of criticality safety accidents. The white paper described the indicators that were observed at Rocky Flats in advance of the 1994 criticality accident near-miss and that accurately foreshadowed the occurrence. Generalized leading indicators were developed and shared with the CSSG and CSCT. The white paper was posted on the CSCT bulletin board and distributed via email. Discussions of the leading indicators by the CSCT with CSSG members led to the CSSG site review that was performed at Y-12 at the request of the NNSA Y-12 Site Office. This is one example of a proactive lessons learned initiative undertaken by the CSSG.

Also, in January 2004, a CSSG member led the NCS review of the Bechtel-Jacobs Company (BJC) NCS Program at the ETTP. This review was a comprehensive assessment of compliance to DOE-STD-1158 done for the Oak Ridge Operations Office (ORO) by a federal team comprised of three CSSG members and three CSCT members. The overall conclusion of the team was that the BJC NCS Program meets the expectations of ANSI/ANS-8.19. The team identified no Issues, six Observations, and three Noteworthy Practices. The program is still maturing, but the elements are in place and functioning. BJC management now has the program

and personnel to ensure that operations are conducted safely and efficiently from an NCS standpoint. BJC has made excellent progress in line management/supervisor involvement in criticality safety and should continue to make this an emphasis of the program. Operator awareness and knowledge of criticality safety has markedly improved as a result of the new nuclear criticality safety evaluation-specific training provided by the NCS staff. Finally, BJC management is developing a Nondestructive Assay (NDA) Program to support Decontamination and Decommissioning (D&D) of the K-25/K-27 buildings and should have an external technical review of this program performed prior to implementation, since it could not be reviewed at this time.

In April 2004, at the request of the NNSA YSO Manager and funded by the NNSA Service Center, members of the CSSG performed a site NCS review at Y-12. The review was stimulated by the promulgation of the leading indicator white paper developed by a CSSG member. The purpose of the review was to examine conduct of solution operations practices in Building 9212 as they impact criticality safety and make recommendations to YSO for improvement. The focus was on operations management and the implementation of the criticality safety program in the facility. This was a technical assistance activity for the YSO, not an 'oversight' compliance review and is another example of a proactive, not reactive, action to improve criticality safety. Therefore, the team was able to make unfettered observations and recommendations based on the experience and knowledge of the team members gained from over 80 years of collective criticality safety experience. The teams report was issued by the NCSP Manager (NA-11) and distributed to senior NNSA management. The three person CSSG team reviewed criticality safety evaluations, policies, and procedures, toured the Oxide Conversion Facility, C-1 and B-1 Wings of Building 9212, observed a pre-job briefing and small group seminar, and interviewed contractor (BWXT) management, staff and operators. The team held daily briefings with YSO and BWXT management and staff to communicate the team's observations in a timely manner. The CSSG's overall conclusion was that while implementation of criticality safety in solution operations in Building 9212 has a solid foundation, there are several areas needing additional attention from operations management. The history of process related criticality accidents shows that fissile solution operations are those most at risk. Operations management at Y-12 must make conscious, disciplined decisions to avoid becoming complacent and contented with the adequacy of the criticality safety program in the absence of high-visibility events. This should result in a continuous reduction in the risk of an accident by improving compliance with safety requirements and reducing reliance on administrative controls. Finally, the CSSG team leader and the NCSP Manager formally briefed the DNFSB on the results of the review in June, 2004.

The CSSG and NCSP Manager recognized the importance of NDA to the criticality safety of D&D projects like that at ETTP and the Hanford Plutonium Finishing Plant (note: a CSSG member led a review of the Hanford NDA program in 2003) and developed a NDA tutorial for criticality safety engineers. A CSSG member met with LANL NDA technical staff in May to outline the NDA needs of criticality safety staff and to develop an outline for the tutorial. The timing of the tutorial was set to provide support to EM sites with major D&D efforts. CSSG

members coordinated with the LANL, NCSP and the American Nuclear Society to present the tutorial at the November 2004 meeting of the ANS in Washington, D.C. In addition, all the materials presented at the NDA tutorial were made available on the LLNL NCSP website. The tutorial presented technical information about the theory, methods, equipment and pitfalls of NDA pertinent to criticality safety evaluations. The day-long tutorial was attended by about 50 people.

Also in May 2004, the Richland Operations Office invited a CSSG member to visit the Hanford site. The CSSG member was guest speaker at the annual Criticality Safety Representatives meeting held at PNNL facilities. Additionally, he provided technical assistance to the Spent Nuclear Fuels programs in the form of document reviews. He met with several members of the Fluor Hanford technical staff tasked with producing criticality safety analyses supporting operations on the Hanford site and also participated in discussions surrounding proposed changes to the Hanford criticality safety program and the Annual Criticality Safety Assessment.

In June 2004, two CSSG members participated in the final biennial NCS review at Rocky Flats. This was a joint activity between the contractor and the DOE Rocky Flats Office. The scope of this assessment was to evaluate the adequacy of the site's criticality safety program, with particular emphasis and concentration in the following areas:

- Adequacy of the current RFETS closure Criticality Safety Program with associated lessons learned;
- Adequacy of current criticality Safety Evaluations, particularly Incredibility Evaluations with associated lessons learned;
- Adequacy of compliance with criticality safety requirements and controls; and,
- Adequacy of site level criticality safety training with associated lessons learned.

RFETS' criticality safety program was determined to be adequately documented and implemented for supporting the safe and efficient closure of the site. The assessment identified two good practices, one opportunity for improvement, and one deficiency. The results of the review were disseminated to CSSG members.

In July 2004, a CSSG member visited the INL to become acquainted with current state of the criticality safety program. Prior to visiting the site he reviewed program descriptive documents, some criticality safety evaluations, and examples of Chapter 6 of facility Safety Analysis Reports. During the visit week, the CSSG member interviewed various Idaho Operations Office staff, Bechtel BWXT staff, and BNFL staff. He also toured the Advanced Mixed Waste Treatment facility, the Accelerated Retrieval Project, the Subsurface Disposal Area, the Transuranic Storage Area, and the Idaho Nuclear Technology and Engineering Center. Observations were reported to DOE ID Management in a trip report that contained a lengthy discussion about the integration of criticality safety into the Authorization Basis (AB) documentation. The report was discussed by CSSG members and contributed to the ongoing work by the CSSG to better integrate the NCS program with the AB.

In September 2004, the DOE Chicago (CH) Office utilized CSSG expertise to assist with reviews of the New Brunswick Laboratory's NCS program and AB documentation. The primary purpose was to help prepare for an upcoming assessment by the Office of Independent Assessment (OA). The CSSG member reviewed criticality safety evaluations, the Safety Analysis Report (SAR), and Unreviewed Safety Question (USQ) documentation and provided recommendations for improvement to CH. The primary need for improvement is in the area of updating the SAR based on USQs performed in the past year or so to reflect and protect the assumptions that a criticality accident is an incredible event at the NBL (which it is!). For example the material at risk (MAR) values listed in the current SAR do not reflect actual practice and do not by themselves reflect the MAR assumed by the crit-incredible USQ and supporting analysis. The OA team identified no new NCS related findings and because of the assistance provided by the CSSG member corrective action plans were already in place when OA arrived. The OA review did not uncover any additional deficiencies.

In October 2004, the Sandia Site Office (SSO) engaged a CSSG member to assist with a limited scope NCS self-assessment of Technical Area V at the Sandia National Laboratory (SNL). The two sections covered from DOE-STD-1158 dealt with MC&A and Criticality Analyses. There were three findings dealing with NCS training of operators, errors in the MC&A inventory in specific storage areas, and the need to perform a major revision to the criticality safety evaluation and DSA for the Auxiliary Hot Cell Facility (AHCF). The team identified specific improvements that should allow the AHCF to be categorized as a Category III Nuclear Facility from a NCS viewpoint at least. However, the as found condition of the analysis and controls did not support such a categorization.

Finally, plans were underway for the CSSG to perform a site review at Los Alamos when the operations stand-down occurred in the summer. The Los Alamos Site Office (LASO) was coordinating with the NCSP and CSSG to arrange for a comprehensive 1158 review of the LANL NCS program. Planning for this review will resume when the operating environment at LANL is able to support it.

The CSSG discusses lessons learned and results of all CSSG related reviews. Reports of reviews are shared among CSSG and CSCT members. In this way virtually all DOE sites are aware at some level of what the CSSG is learning about safety. The NDA tutorial is, itself, a lessons learned because the CSSG and the NCSP identified NDA as an area needing attention and proactively provided this training for the Department's NCS staff. The CSCT regularly shares lessons learned and good practices on its web based bulletin board.

Finally, the CSSG provided information on the Department's lessons learned from the Tokai-mura criticality accident and the leading indicator precursors developed from the Rocky Flats white paper case study on forecasting the potential for a criticality accident to the NNSA Chief of Defense Nuclear Safety for inclusion in the December 2004 edition of the NNSA Technical

Bulletin. This is a new formalized lessons-learned vehicle established by NNSA to which the CSSG will continue to contribute as requested and as appropriate.

8. Lessons learned from CSSG reviews of criticality safety controls for new facility designs

The CSSG has been closely following the NNSA plans to relocate the TA-18 mission and critical experiments facility to the Device DAF in Nevada. In March, the CSSG convened in Las Vegas for the first of two NCSP reviews that occur each year. The CSSG received briefings on NNSA's plans for relocation, the impact on experiments and training, and toured the DAF while in Nevada. Later, in June, the CSSG issued formal recommendations to the NCSP manager to help in the planning for the project. The CSSG, working with the NCSP manager, helped initiate the plans for an early move of critical assemblies to the DAF so that experiments can resume at the DAF as soon as practicable. Also high on the CSSG recommendation list is the preservation of human capital and associated expertise during the transition period. The CSSG continues to monitor the progress of the TA-18 to DAF transition and provides feedback regularly to the NCSP manager. One member of the CSSG is currently on detail to NNSA with the specific task of helping the Nevada Site Office establish viable criticality safety programs in Nevada. In addition, this individual will draw upon the expertise resident in the CSSG to review proposed controls for the critical experiments facility in the DAF and assure that an appropriate set of controls are established.

Another ongoing project being supported by the CSSG is the Oak Ridge Building 3019 U233 processing facility being done by ISOTEK under contract to the DOE Office of Nuclear Energy, Science and Technology (NE). In June 2004, a CSSG member traveled to Oak Ridge to meet with DOE Oak Ridge Operations (ORO) and ISOTEK staff to review draft NCS programs and procedures and to review the preliminary design of the facility. The CSSG member provided recommendations for improvements including, most importantly, the need to use SCALE-5 with its TSUNAMI capabilities coupled with the recently re-measured U233 cross sections. At the time of the review, a 5% penalty in sub-critical margin was arbitrarily being assigned (probably appropriately) by the ISOTEK NCS staff due to the uncertainties in the code and cross section set they used. With the capabilities of TSUNAMI coupled with the best available cross-sections the uncertainty in the sub-critical margin can be more accurately determined. It may or may not be smaller than 5% but it will be better understood and quantified analytically based on the best available methods developed by the NCSP. The CSSG worked with the NCSP manager and ORNL staff (also CSSG members) to allocate $60K of funding to perform TSUNAMI calculations on existing U233 benchmarks. CSSG members also subsequently met with ISOTEK staff to discuss their needs and how the NCSP/CSSG can support safe, efficient NCS evaluations supporting the facility and processing design. The work continues on with the CSSG reviewing the 60% design of the facility and plans to review the PDSA.

Lessons learned from CSSG reviews of these new facility designs and future reviews will

continue to be disseminated as described in the last paragraph of section 7, above.

9. Trending and analysis of reportable and non-reportable criticality safety occurrences

In late 2003, the CSCT worked to improve its ability to characterize deficiencies and infractions to better deduce lessons learned, share the information across sites more efficiently, and develop effective corrective actions. The CSCT undertook the development of a web-based database for tracking/trending reportable and non-reportable criticality safety deficiencies and infractions. The data that was used to populate this database is routinely collected by the contractors as part of their requirements to comply with ANSI/ANS-8.1 and 8.19. The CSCT did track/trend deficiencies/infractions monthly using this protocol beginning in January 2004, analyzed the occurrences, and uploaded the data monthly. The database is accessible only by CSCT members, in order to protect the integrity of the data. The information used by the CSCT for this purpose was input into the database in the format shown below.

CSCT Infraction Reporting/Tracking Format

Date:
Site:
Building/Facility and Contractor:
Reporting CSCT Member:
Discovered by (Contractor/DOE; Criticality Safety/Operations):
ORPS Reportable (Y/N):
Brief Description of Operation:
Brief Description of Infraction/Deficiency:
Infraction/Deficiency Category (List all that apply):

- Mass
- Volume
- Concentration
- Spacing/Interaction
- Labeling
- Unauthorized/Improper Transfer or Location
- Unauthorized/Improper Fissile Material Type/Form
- Improper/Inadequate Criticality Safety Posting
- Unauthorized/Improper Containers
- Unauthorized/Unanalyzed Operation
- Operation without Criticality Safety Posting/Limits
- Moderation/Flooding/Wetting
- Criticality Safety Alarm System Failure
- Limiting Condition for Operations Violation
- Technical Safety Requirement Violation

- Other (Describe)

Causal Factors (List all that apply):

- Less Than Adequate (LTA) Work Planning/Hazards Analysis
- LTA Pre-Job Walk-Down
- LTA Pre-Job Brief
- LTA Fissile Handling/Operational Procedures
- LTA Policies or Program Procedures
- LTA Training
- Failure to Follow Operational Procedures
- Failure to Follow Policies/Program Procedures
- Equipment Failure/Error
- Discovery of Pre-Existing Condition
- LTA Criticality Safety Evaluation
- Software Failure/Error
- Surveillance Failure
- LTA Assay of Material
- LTA Materials Control and Accountability
- Other (Describe)

From January through June the CSCT members, several of which are also CSSG members, reviewed this deficiency/event information monthly and discussed observations on the monthly teleconference calls. By June 2004, it became apparent that this data was not dramatically improving the ability to understand emerging criticality safety problems or potential problems at the sites and a small subcommittee of the CSCT performed a mid-year self-assessment of the program to provide feedback on improving the process.

Meanwhile, another data point had emerged. In April 2004, the CSSG completed its Y-12 review at which ALL the available information was reviewed pertaining to reportable and non-reportable criticality safety deficiencies/infractions for the past year at the Y-12 site. When all the Y-12 site's information was presented to the CSSG, patterns did emerge that provided insight into weaknesses in the Y-12 NCS program. These patterns could not be discerned from the CSCT tracking database alone. For example, some of the information available at the site could not be uploaded without classifying the database. Also, the volume of information would have been prohibitive and not easily cast into a searchable database. Particularly useful to the CSSG's NCS review were information on repeat infractions/deficiencies, recommended action plans for preventing recurrence, information on specific groups/supervisors that were involved, and information on funding requests, mechanisms, and line management organizational structure.

Based on the midyear review of the database and the results of the comprehensive onsite review at Y-12, the CSCT sub-committee recommended that while the CSCT database provided

information that was not completely useless, it was nevertheless, far less than optimal. It was just a collection of numbers that did not reveal any correlated patterns, even at a specific site level. Given the increasing security concerns and the lack of general utility the CSCT stopped entering information into the database in July 2004.

The recommended path forward is to incorporate a comprehensive review of all available information on reportable and non-reportable criticality safety deficiencies/infractions into site reviews performed by the CSSG. It is anticipated that the CSSG will perform technical assistance reviews of some sort at several sites per year. The exact number and protocol for accomplishing this is yet to be determined because the Department's Implementation Plan for Board Recommendation 2004-1 is not yet final, nor is it clear how the CSSG will involve itself in the activities being planned in the Implementation Plan. However, it is clear from the experience at Y-12 that a CSSG review of all available site information at one time looking back for a year or so can yield valuable insights and opportunities for improvement in a site's NCS program. In addition, the CSCT and CSSG will also consider looking into improvements and developments in the ORPS process for lessons learned relative to criticality safety. The CSCT and CSSG continue to monitor in real time the reportable events that are documented in ORPS. Finally, lessons learned from trending analysis as a result of CSSG reviews will continue to be disseminated as described in the last paragraph of section 7, above.

10. Open issues identified in the previous annual report

There were five open issues identified in last year's report. The status of each of these is presented in this section.

Issue 1: Optimizing the use of CSSG expertise to assist site office and contractor line management and developing a system for sharing lessons learned.

The Board's specific recommendation relative to what became the CSSG in its Recommendation 97-2 is listed below.

> *Board Subrecommendation 8:*
>
> *Identify a core group of criticality experts experienced in the theoretical and experimental aspects of neutron chain reaction to advise on the above steps and assist in resolving future technical issues.*

In the Department's Implementation Plan for Recommendation 97-2, DOE committed to form the CSSG with the following purpose.

> *The Department will form a group of experts that is composed of persons from its staff and the site contractors having collective knowledge in a broad spectrum of criticality*

safety areas to advise the Departmental management team on programmatic issues and to help resolve present and future technical criticality safety issues.

The CSSG, in its technical support function to the NCSP Manager and the Department, fulfills its charter and the intent of the Department's commitment in the Implementation Plan to the Board's recommendation by providing expert technical advice on the NCSP program elements and assistance in resolving criticality safety related technical issues. In addition to providing technical advice regarding the NCSP program elements, the CSSG reviews described in detail in Section 7, above, clearly demonstrate that it is fulfilling the Department's original commitment to the Board. While the NCSP will continue to optimize the use of CSSG expertise to assist site office and contractor line management, the Department's recently approved implementation plan for Recommendation 2004-1 includes additional actions to develop a system for sharing lessons learned. The Department considers this issue closed.

Issue 2: Resolution of issues surrounding the relationship between criticality safety evaluations/controls and authorization basis documents;

and,

Issue 3: Resolution of issues regarding the way criticality safety is addressed in the DOE Implementation Guides for Title 10 of the Code of Federal Regulations, Part 830, *Nuclear Safety Management*.

Issues 2 and 3 are being addressed by developing a revision to DOE Order 420.1 and re-writing DOE-STD-3007. The CSSG has had major input to the complete revision of the criticality safety section of DOE O 420.1 and the draft now reflects the long-standing CSSG position that criticality safety be conducted according to the national consensus ANSI/ANS-8 Standards without substantial modification by the DOE. The Department recommended in the report of it's assessment of the criticality safety program subsequent to the Tokai-mura accident that DOE-STD-3007 be converted from an optional format guide to a mandatory criticality safety evaluation standard. The revision to 3007 is now underway and will contain major new sections dealing with the linkage between criticality safety and the authorization basis. Drafts of this revision have been discussed by the CSSG, EH, and the Energy Facility Contractor Operations Group Safety Analysis Working Group at meetings during the past year. The new 3007 will have sections on selecting TSR level criticality controls and developing a 'bridging document' between criticality safety evaluations and the authorization basis. It will also provide guidance on how to address beyond design basis criticality accidents and dose calculations. The draft revision to DOE O 420.1 contains language that makes compliance to DOE-STD-3007 a requirement. The NCSP and CSSG will continue to work this issue through to completion along with other involved Departmental elements. It is expected that both revisions will be finalized and published in 2005.

Issue 4: The potential relocation of the Los Alamos Critical Experiments Facility activities conducted at LANL TA-18.

See Section 4, above, for a TA-18 relocation status. This issue will be carried forward as an open issue until the integral experiments and training programs are fully functional in Nevada.

Issue 5: Federal oversight of LANL, Sandia National Laboratories, and Pantex criticality safety programs.

Federal oversight of LANL, Sandia National Laboratories, and Pantex nuclear criticality safety (NCS) programs has been dramatically improved. The NNSA Service Center has hired a second criticality safety professional with more than 20 years of experience in the field. He will provide criticality safety support on an ongoing basis to these three sites. In addition, LASO has identified an experienced nuclear safety person who is in the process of becoming formally qualified in NCS. This individual has been working closely with the CSSG and the Office of Environment, Safety and Health in developing the major revision to DOE-STD-3007 and is an active member of the CSCT. Finally, NNSA has added a senior CSSG member to its staff that will be available to provide technical assistance to all NNSA sites, including the NSO and its ongoing activities to support the transition of TA-18 to the DAF. The Department considers this issue closed.

11 Open Issues

Several issues will be carried forward as open issues requiring further work. These are:

- The relocation of the Los Alamos Critical Experiments Facility activities conducted at LANL TA-18 to the DAF.

- Issuing revisions to DOE O 420.1 and DOE-STD-3007.

12 Conclusion

Overall, the NCSP has made significant progress in maintaining important criticality safety infrastructure and supporting operational programs. Funding has been stabilized and the NCSP is leveraging its assets to provide support for the most pressing operational criticality safety needs. Both the LACEF and the Oak Ridge Electron Linear Accelerator are recognized as important contributors to the NCSP and are being supported. Training and qualification programs are functioning. Pertinent criticality safety information is readily available on web sites supported by the NCSP, and feedback from the criticality safety community is being used to plan program work. The CSSG is actively providing technical support to the NCSP and technical assistance to the sites. Through implementation of the NCSP, a viable process for assessing needs and enhancing criticality safety has been institutionalized.